NASA Glenn Expertise in Wind Power Systems

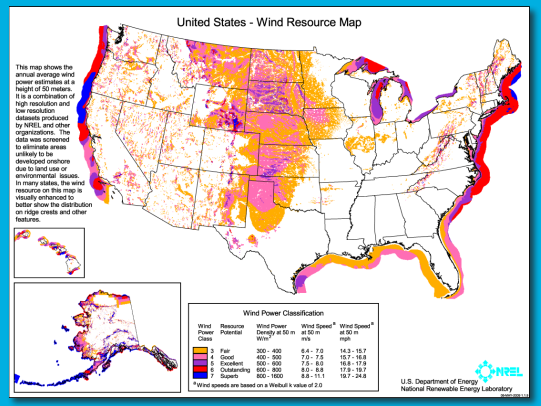
Installation of the nacelle on the 2.5-megawatt Mod-2

Instrumentation installation

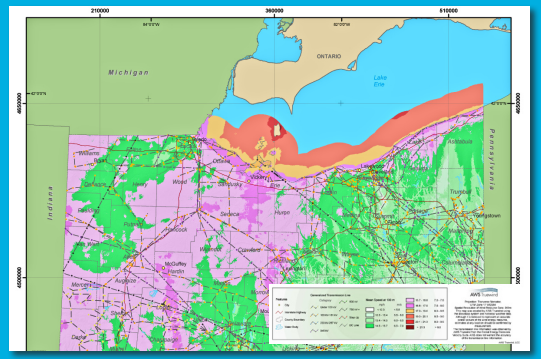
Rotor installation

General Information

NASA Glenn Research Center
www.nasa.gov/centers/glenn/home/
Glenn Test Facilities Guide
http://facilities.grc.nasa.gov/documents/facilities_Booklet_2005.pdf
Glenn Research Center Resume
www.nasa.gov/centers/glenn/about/
Business Development and Partnership
http://newbusiness.grc.nasa.gov



United States—Wind Resource Map
Source: U.S. Department of Energy



Offshore wind energy products represent tremendous opportunity, but significant technology challenges must be overcome.

Business Development and Partnership Office

Dr. Robert (Joe) Shaw, Chief
21000 Brookpark Road, MS 49–5
Cleveland, OH 44135
Phone: 216–977–7135
Fax: 216–977–7133
E-mail: Robert.J.Shaw@nasa.gov

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National Aeronautics and Space Administration

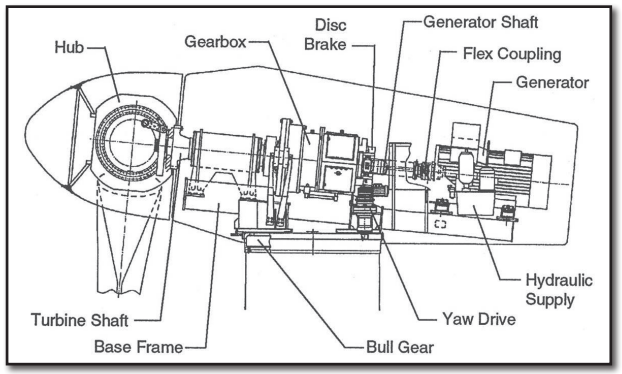
Wind Turbine

Wind Turbine Experience

Bibliography of NASA Related Publications on Wind Turbine Technology 1973-1995

http://gltrs.grc.nasa.gov/cgi-bin/GLTRS/browse.pl?//all/CR-195462.html

WTS-4 (4 megawatt wind turbine system)—Installed in 1981, this wind turbine was the most powerful in the world until 2004 (NASA-DOI-Hamilton Standard).



To provide consistent durability of wind power systems, the power trains represent a significant engineering challenge.

Gas Turbine Competencies Applied to Wind Turbines

Acoustics

This competency primarily conducts fundamental and applied research to reduce propulsion noise. Technologies include steady and unsteady aerodynamics, performance assessments, near-field phased microphone array, and duct and acoustic measurements.

Instrumentation and Controls

The primary goal of this competency is to develop sensors for harsh environments, optical instrumentation systems, and nondestructive evaluation (NDE) techniques, such as radiography, acoustics, and various ultrasonic inspection techniques.

Communications

The goal of this competency is to develop communications systems and networks based on technologies that include radiofrequency components and devices, digital and wireless communications systems, and communications networking techniques. Health monitoring and maintenance scheduling could be addressed.

Computational Fluid Dynamics

The goal of this competency is to perform experimental and computational fluid dynamics research for the design and development of engine inlets, turbomachinery, and exhaust systems to advance the understanding of flow physics, operability, efficiency, and cooling techniques.

Icing

This competency conducts ice accretion experiments and modeling, and ice breakup and “throw” modeling to predict ice particle trajectories. It also works with materials compatibility, blade design, blade-tip modeling under icing conditions, in situ icing forecasts, and measurements in and around northeast Ohio, including Lake Erie.

Materials

This competency develops processes and characterizes materials for aerospace applications. Metallic, ceramic, and polymeric materials are the current focus, both monolithics and composites.

Mechanical Components

This competency group evaluates and improves gears, bearings, and drive system technologies and studies the fundamentals of lubrication of drive systems by conducting fatigue testing to enable the development of advanced materials, processing, and coatings for gears and bearings.

Multidiscplinary Design and Optimization

The competency assesses aeronautics and space program activities by calculating performance and economic benefits of advanced and unconventional technologies. These assessments help influence NASA’s decision-making process and strategically guide the direction of its technology portfolios.

Program Management

The ~100 project and program managers at Glenn have experience in managing 119 Centaur rocket launches, the Space Station Freedom power system, Ares launch vehicle systems, as well as numerous electric propulsion, communications, aeropropulsion, and microgravity projects.

Structural Design

The goal of this competency is to study and model fluid-structures interactions and to predict and verify structural dynamic responses, loads, vibration, and shock environments for aerospace structures.

System Analysis and Engineering

This competency focuses on using tools to analyze aerospace vehicles, propulsion, and power concepts. It is focused on the development and maintenance of systems engineering processes and the application of engineering processes at a systems level.